

## Toxicities of Oils, Dispersants and Dispersed Oils to Aquatic Plants: Summary and Database Value to Resource Sustainability

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Understanding the phytotoxicities of crude and dispersed oils is important for near-shore ecosystem management, particularly post-oil spills. One source of information is toxicity data summaries which are scattered and outdated for aquatic plants and petrochemicals. As a result, a current review is needed to determine any advances in the published toxicity database and if risk assessments and phytotoxicity predictions can be achieved without additional data generation.

Toxicity results are summarized for oils, dispersants and dispersed oils on non-vascular and vascular plants specifically of those representative in open water and near-shore wetlands, seagrass meadows and mangrove habitats. Aquatic plants have varied morphologies, physiologies and life history characteristics that have impacted the experimental design and relevancy of phytotoxicity test results. The phytotoxicity database is historically uneven and dominated by information generated largely as a reactive response to large oils spills. Toxicity investigations have been conducted for 3hrs to 3 yrs with at least 33 crude oils and 54 dispersants in laboratory, greenhouse and *in-situ* studies. Most toxicity information is for weathered crude oils and dispersants no longer in use. As many as 71 structural response parameters have been determined post-petrochemical exposure for 83 species of micro- and macroalgae, 27 wetland plants, 14 mangrove species and 9 seagrasses. Most toxicity tests have been conducted with single test species, test compounds and doses. The magnitude of inhibition, stimulation and recovery observed after exposure to oils, dispersants and dispersed oils has varied with test species, life stages, test durations, types and forms of oils and dispersants, response parameters, oil-dispersant ratios, media dosed and dose application methods. As a consequence, toxic effect concentrations vary by orders of magnitude (effect concentration range = 0.025 to 10,000 ppm) which limits a relevant ranking of most oil and dispersant toxicities, sensitive plant species and response parameters. This lack of information restricts use of species-sensitivity distributions, pre- and post oil spill phytotoxicity predictions, natural resource damage assessments and restoration efforts needed to sustain plant-dominated ecosystems. Therefore, evidence-based risk assessments for most aquatic plants and oils, dispersants and dispersed oils are not supported by the current scientific literature. This limitation was recognized over 30 years ago indicating a lack of research progress. A proactive and experimentally-consistent approach is recommended to provide baseline acute, chronic and threshold toxic effect concentrations for these contaminants and sensitive life stages of aquatic plants inhabiting diverse near-coastal habitats. Included in this effort is the need for determinations of mixture- and oil-contaminated sediment toxicities and field validation of laboratory-derived toxicity test results.

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